
Feature operation

DTI emulates both analog trunks and digital channel banks, while acting as an interface between Meridian 1 and digital transmission lines. DTI outputs digital signals at DS-1 level in either D2 or D3 format and with X11 release 11 or later software in D4 or ESF formats. The appropriate trunk signaling, basic trunk states, timing, and trunk processing are the same as the analog processes.

Interface functions are handled by DTI software:

- input/output messages
- pad setting
- Echo Cancellor control
- data call recognition
- data call signaling to the next switch

These functions are under control of the trunk and DTI software modules. DTI supports both dual tone multifrequency (DTMF) and dial pulse address signaling (the traffic provisioning ratio for DTMF is the same as provided for analog trunks).

Voice call processing

A general description of voice call processing is given in the following paragraphs.

Idle condition A digital trunk (DTI channel) must be idle to be available for outgoing calls. Idle state indications are different for different trunk types. These are handled automatically by DTI. When a trunk (channel) is idle, the DTI, under control of the CPU, sends idle PCM code (7F hexadecimal) on the voice/data timeslot of the idle channel.

Outgoing calls

Trunk seizure When a caller dials a digital trunk route, the digit processor selects an idle trunk (a DTI channel) associated with the dialed route and sends seizure and pad control messages to the DTI hardware.

Note: The route consists of digital trunks only. Analog and digital trunks are not mixed in a route, but a DTI loop can have 24 routes.

The DTI hardware sets the proper digital pads, using A & B bit signaling, and sends an “off hook” message that is detected at the far end as a change of state. When it is ready to receive, the far end trunk (depending on its supervisory mode) informs the DTI by sending the appropriate A & B bit signal. After receiving this message, the DTI sends a seizure message to the far end. This is equivalent to an analog trunk closing the loop and must be done within 210 ms to avoid false signaling. The Echo Canceller, if equipped, remains enabled.

Outpulsing After receiving the seizure signal, or after an appropriate timing interval, the far end sends dial tone to the Meridian 1 and waits to receive dual tone multifrequency (DTMF) or dial pulse (DP) address signaling, depending on the type of trunk (in the case of DTMF, digitized DTMF frequencies are transmitted on the active channels). The calling party dials the destination number. The Tone and Digit Switch (TDS) generates the pulses and timing on an enabled network voice timeslot. The DTI extracts this information and transmits DS-1 A & B bits to the far end in the appropriate signaling frame.

Answer When the far end receives the address signals, the call is routed to the dialed destination. If the called party answers, the far end returns an A & B bit answer signal to the DTI. DTI, in turn, notifies the CPU and a speech path is cut through.

Release Guard and disconnect supervision timing and idling of the trunk are the same in operation as those of the analog trunk. After receiving a release message from the CPU, the DTI sends a release message (idle state) to the far end by means of A & B signaling bits. When the CPU sends the idle trunk message to the DTI, it starts sending the Idle PCM code on nonsignaling frames on the idle channel.

Glare When a glare condition occurs (both ends of the same trunk attempt seizure at the same time), priority is given to the incoming call. In this case, the operation is the same as that of an analog trunk.

Incoming calls

Trunk seizure When the DTI hardware detects an A & B bit change of state on an idle DTI channel, it notifies the CPU. The CPU interprets the A & B bit state and takes the following action:

- **Central Office trunk** The CPU tells the DTI hardware to set up digital pads. It also alerts the Attendant or Night Station Directory Number (DN) (except on Direct Inward System Access [DISA] trunks).
- **TIE or Direct Inward Dialing trunks** The CPU attaches the Digitone receiver (DTR) in the case of dual tone multifrequency (DTMF) trunks, or interprets the A & B bits for the destination address in the case of dial pulse (DP) trunks. The address signals are processed by the digit processor and the called party is alerted. The CPU tells the DTI to set up digital pads for the call.

Answer When the call is answered, Meridian 1 software sends the appropriate answer message to the DTI. The DTI informs the far end and cuts through a speech path.

Release Guard and disconnect supervision timing and idling of the trunk are the same in operation as those of an analog trunk. DTI relays the release message for the CPU (idle state) to the far end by means of A & B signaling bits. When the CPU sends the idle trunk message, the DTI starts sending the Idle PCM code on nonsignaling frames on the idle channel.

Data call processing

Trunk timing and trunk transition used to set up data calls are similar to those used to set up voice calls with the following exceptions.

Mixed voice/data

When data calls using a route with mixed voice/data assignments are switched through a private network, intermediate switches must be signaled during call setup. This is done to ensure that:

- the tandem connection is made to digital facilities if Automated Modem Pooling is not provided
- the digital pads are not applied
- the Echo Cancellers are disabled on the data connections

This signaling is achieved by using the special address prefix or an equivalent format such as Electronic Switched Network (ESN) “call type” network signaling. Signaling on DTI for Standard (STD) and ESN trunk group option (shown in [Table 2](#)) is defined in LD16 in response to the SIGO (signaling arrangement) prompt.

Table 2
Network signaling on DTI

Trunk group	Call type	Digit	Sub-call type	Digit
Option (SIGO)				
STD	SIG STD VOICE	1		
	SIG STD DATA	2		
ESN5*	SIG DTI DATA	7	DTI CCBQ ALLOW #	1
			DTI STD NCOS #	2
			DTI STD TCOS +	3
			DTI SAT CCBQ #	4
			DTI SAT NCOS #	5
			DTI SAT TCOS +	6
* Call types 1-6 are treated as voice call. They have the same meanings as in ESN2 ESN3.				
# Followed by a 2-digit NCOS				
+ Followed by a 2-digit TCOS				

Voice calls only

When voice calls are switched through a private network on a voice calls only (VCE) route, special Electronic Switched Network (ESN) signaling is not required. Digital pads are applied as required, and Echo Cancellers are permanently enabled.

Data calls only

When data calls are switched through a private network on a data calls only (DTA) route, special Electronic Switched Network (ESN) signaling is not required. Digital pads are not applied and Echo Cancellers are permanently enabled.

Data call limitations

Analog and digital calls cannot be mixed in the same route. However, in cases where an analog facility runs parallel to a digital link, voice calls from the analog route are allowed to overflow onto the digital route and vice versa. Digital data calls do not overflow onto analog routes.

To prevent the inadvertent generation of false yellow alarms on a digital trunk loop, the number of data calls allowed on a digital trunk loop is limited to a value that is configured on a loop basis. This is done in LD17 in response to the DLOP (digital trunk loop) prompt. The range of possible values for a maximum number of data calls is 0 to 24. The default value is 24. False yellow alarms can be caused by high-speed synchronous data being present on *all* channels for an extended period of time. If this special condition is a provisioning criterion, consult your Northern Telecom sales engineer.

Recognition of data calls

Outgoing calls A bit in the terminal block identifies whether the call is from a voice or a data terminal.

Incoming calls Incoming calls are identified by their special call type or route type (that is, dedicated for voice or data usage).

Digital connectivity

Digital data routes must be engineered so that end-to-end connectivity is provided. Intermediate switches must route data calls over digital trunks and must not insert pads or Echo Cancellers. (Call identity digits are not stripped unless the succeeding loop has dedicated voice or data channels.)

Digital pad control

DTI software instructs its hardware to switch off digital pads for a particular channel when a digital data call is initiated for that channel. This is done to maintain bit integrity on such calls.

The DTI software inserts digital pads for both transmit and receive directions (on a per channel basis) to achieve the desirable port-to-port transmission loss values for each type of connection as identified by the Channel Classmarks.

Note: The net loss of a particular overall port-to-port connection is the combination of this DTI pad loss *and* the pad loss of the connecting analog line. All of the various insertion loss specifications for DTI overall port-to-port losses are listed in *Summary of transmission parameters* (553-2201-182) and conform to the EIA document PN-1429.

DTI/CPI Channel Classmarks

Channel Classmarks (see [Table 3](#)) are used for different types of connections for signaling and pad-setting purposes. Digital pad values are assigned for the appropriate timeslot (in accordance with the Pad Switching Table) during call processing when both the near and far end ports are known. When both ports of a connection are digital, only one port is assigned a pad value. The other port is automatically assumed to be zero.

Table 3
DTI Channel Classmarks

Number	Class	Explanation
1	ONS	Line interface/on premise line
2	OPS	Line interface/off premise line
3	ATT	Analog trunk interface/analog TIE trunk
4	AOT	Analog trunk interface/analog satellite PBX TIE trunk when PBX includes OPX telephones
5	SCTT	Digital trunk interface/combination satellite PBX TIE trunk
6	DTT	Digital trunk interface/digital or combination TIE trunk
7	ACO	Analog trunk interface/analog CO trunk
8	DCO	Digital trunk interface/digital or combination CO trunk
9	ATO	Analog trunk interface/analog toll office trunk
10	DTO	Digital trunk interface/digital or combination toll office trunk
11	SDTT	Digital trunk interface/digital satellite PBX TIE trunk
12	SATT	Analog trunk interface/analog satellite PBX TIE trunk

Echo Cancellor

DTI hardware, under control of DTI software, disables the Echo Cancellor on a per channel basis on data calls over satellite. If the Echo Cancellor cannot be controlled dynamically (that is, on a per call basis), some channels should be set to voice calls only and some to data calls only. Echo cancellation should then be manually removed for the data calls only channels.

Tandem switches

A Meridian 1, acting as a tandem switch, can perform the following tasks on data calls:

- recognize the special call type for data calls
- absorb the prefix if necessary
- route data calls to the appropriate trunks
- suppress digital pads
- disable Echo Cancellers
- if necessary, insert and send special call type prefix to the next switch down the line

In certain cases, one or more of these requirements may not be needed. This depends on the signaling and transmission requirements of the tandem.

Trunk supervision

Trunk supervision signaling is dependent on the trunk type being emulated by the DTI.

Computer-to-PBX Interface application

The Computer-to-PBX Interface (CPI) uses DTI as a multiplex interface between Meridian 1 and a host computer. The operation of DTI when used in a CPI application is the same as for other applications. However, the following considerations must be made:

Channel assignments The DTI channels associated with CPI are classmarked Data Only and must be configured in one of the following ways:

- one-way TIE trunks arranged for manual outgoing service
- two-way TIE trunks arranged for manual outgoing and incoming service
- two-way TIE trunks arranged for manual outgoing and wink-start incoming service

Remote (yellow) alarms Remote (yellow) alarm recognition and transmission are disabled in the DTI and are not provided at the host computer interface.

Echo Cancellers Echo Cancellers must be disabled or removed.

Synchronization If the transmission facilities require the Meridian 1 to be synchronized with the digital network, then the Clock Controllers must be used as DTI applications.

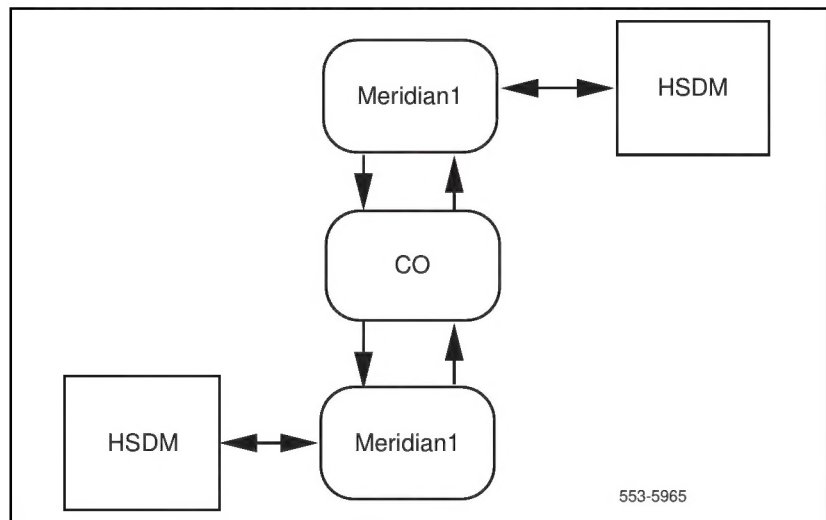
Note: Clock Controllers are not required for the CPI application (except if the connecting facility is repeatered and requires synchronization).

Public Switched Data Service

The Meridian 1 Public Switched Data Service (PSDS) is a digital data feature that provides a pure 56 kbps data call between the following:

- a Meridian 1 and the Central Office (CO)
- a tandem call from an SL-100 to a Meridian 1
- a Meridian 1 and other Public Switched Data Service-compatible switches. See [Figure 5](#).

Figure 5
Public Switched Data Service between Meridian 1 and Central Office



Note: For information on how to implement this feature, refer to *X11 features and services* (553-3001-305) and *X11 input/output guide* (553-3001-400).

The customer can install a T1 link to different vendors and use the Meridian 1 data unit to initiate or receive a 56 kilobit digital data call. The digital data call then transports across the vendor's digital network to another Meridian 1 or SL-100.

The Public Switched Data Service (PSDS) supports DTI trunks, TIE and Direct Inward Dial (DID)/Direct Outward Dial (DOD) trunks, and Electronic TIE Network-compatible signaling (ETN).

Operation

The data selection (DSEL) in the route data block can be defined as voice calls only (VCE), data calls only (DTA), or voice or data calls (VOD). The call can be defined as voice calls, regular data calls, or Public Switched Data Service (PSDS) calls. Refer to *X11 input/output guide* (553-3001-400) to configure the route data block.

For direct access, the user dials the regular seven- or ten-digit Directory Number (DN). The translation selects the TIE or Direct Inward Dial (DID)/Direct Outward Dial (DOD) DTI trunks. If the normal public access trunks are analog trunks, the data DN needs to be separated into an Electronic Switched Network (ESN) Special Number so the user can access the digital DTI facility.

For special route access, the user dials a route access code after hearing a dial tone. All the trunks in that route are one of TIE or DID/DOD DTI trunks.

Configurations

End to End DTI network For all Meridian 1 Networks (Point to Point), users can access the existing data facility in the Meridian 1 to support data calls, or they can select the Switched 56 data mode. For mixed vendors private network, users can select only the Public Switched Data Service mode.

Receiving data calls

A call can be answered either automatically (by a switch located inside the data module) or manually (by pressing the data Directory Number [DN] key on the data module).

Public Switched Data Service (PSDS) call on Primary Rate Interface The following routes are possible using this feature on Primary Rate Interface (PRI):

- **Point to point access** For point to point access of TIE trunks, the software can be modified to handle the requirements of this feature.
- **Tandem call** For tandem access, additional information on this feature is needed, or the data call can be defined as a voice call.
- **DID/FX/WATS/Accunet** The Meridian 1 supports PSDS data calls to these trunk types.
- **Public Network Hopoff** Signaling informs the tandem switch about the PSDS data call.